**T-7: Diesel Engine Emission Reductions and Fuel Efficiency Improvements**

In addition to the stated benefits in the 2007 T-7 draft strategy, diesel engine emission reductions may have additional climate protection benefits from the reduction in diesel soot. We reviewed recent research and found the following:

- National experts identified black carbon emissions second only to carbon dioxide ($CO_2$) in causing global warming, and may have as much as 60% of the global warming effect of CO2.[1] Black carbon adds 2-3 orders of magnitude more energy to the climate system than an equivalent mass of $CO_2$.[2],[3]

- New research also suggests that black carbon emissions may explain a significant fraction of the observed arctic warming, which is approximately twice as rapid as the rest of the Earth.[4] Similarly, a recent analysis by the U.S. Climate Change Science Program finds that "by the year 2100, short-lived gases (e.g. soot) and particles may account for as much as 40 percent of the warming over the summertime continental US."[5]

- Unlike carbon dioxide, which remains in the atmosphere for several decades, black carbon remains in the atmosphere for ten days to two weeks. As a result, decreasing emissions of black soot by implementing programs such as those identified in T-7 may have immediate climate protection benefits. Installing diesel particulate filters and other soot reducing after-treatment devices on diesel engines, retrofitting diesel engines in the marine industry, and transitioning to alternative fuels are a few examples of existing technologies that could be employed to reduce diesel particulate and black carbon.

Based on this review, we recommend adding the following to T-7:

Under the Mitigation Option Description, add the following:

> Furthermore, these strategies will likely have climate protection benefits because they reduce black carbon, a key component of diesel soot. Recent scientific

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[1] Ramanathan V. Scripps Institution of Oceanography University of California at San Diego. *Role of Black Carbon on Global and Regional Climate Change.* Testimony to the House Committee on Oversight and Government Reform. October 18, 2007.
[2] Jacobson, MZ. *Testimony for the Hearing on Black Carbon and Arctic, House Committee on Oversight and Government Reform.* United States House of Representatives. October 18, 2007.
[3] Bond TC. Testimony for the Hearing on Black Carbon and Climate Change. House Committee on Oversight and Government Reform. US House of Representatives, October 18, 2007.
[4] Zender CS. *Arctic Climate Effects of Black Carbon.* Written Testimony to the Oversight and Government Reform Committee. United States House of Representatives. October 18, 2007.
[5] Climate Change Science Program, 2008: *Climate Projections Based on Emissions Scenarios for Long-Lived and Short-Lived Radiatively Active Gases and Aerosols*, Executive Summary. H. Levy II, D.T. Shindell, A. Gilliland, M.D. Schwarzkopf, L.W. Horowitz, (eds.). Department of Commerce, NOAA's National Climatic Data Center, Washington, D.C., USA

articles and analyses have clearly identified black carbon as an important contributor to climate change.[6],[7]

Under the section entitled "Mitigation Option Design, Multi-sector technologies," add the following:

- Engine retrofits. Washington State should support and promote diesel emission reduction programs. These programs have the potential to provide climate benefits, especially if they are extended to private fleets, as most public fleets have now been retrofitted. These benefits are in addition to the public health benefits afforded by significant reductions in highly toxic diesel particulate.
- Develop anti-idling rules. Although a small source of emissions, reductions here also provide direct fuel savings and air quality benefits.
- Accelerate fleet turnover. Washington should develop regulatory approaches to speed introduction of new, cleaner engines, recognizing that this may be highly cost-effective with the increasing price of fuel.
- Consider reducing emissions from other sources of black soot such as woodstoves and fireplaces. By 2018, Ecology projects that diesel emissions will be 12% and that woodstove and fireplace emissions will be 29% of the PM2.5 emissions inventory, respectively.

Under Implementation Mechanisms, Supplement Existing Programs, add the following:

- Ensure additional state and local agency resources are available to monitor and quantify the potential climate benefits of diesel retrofit programs. While new information continues to emerge, recent analyses suggest that the global warming potential of black carbon has been underestimated.[8] The State of Washington and local air agencies should assess new data as it becomes available.

[6] Intergovernmental Panel on Climate Change, *Climate Change 2007: The Physical Science Basis*, Chapter 2: Changes in Atmospheric Constituents and in Radiative Forcing.
[7] Ramanathan V and G Carmichael. *Global and Regional Climate Change due to Black Carbon*. Nature Geoscience Journal, 2007.
[8] Ramanathan V and G Carmichael, 2007